
II. *Of the Formation of the Vegetable Epidermis.* By the Rev.
Patrick Keith, F.L.S.

Read March 7, 1815.

THE pellicle that constitutes the vegetable epidermis has generally been regarded as a membrane essentially distinct from the parts which it invests, and as generated with a view to the discharge of some peculiar functions in the vegetable œconomy. Some phytologists, however, have viewed it in a light altogether different, and have regarded it as being merely the effect of accident, and nothing more than a scurf formed upon the exterior and pulpy surface of the parenchyma indurated by the action of the air. This was the opinion of Grew and Malpighi, and, though it does not seem to have ever met with any very general reception, has been revived of late by M. Mirbel, who, professing to be dissatisfied with the analogy that has generally been thought to exist between the epidermis of the animal and vegetable, contends that the latter is nothing more than the indurated surface of the parenchyma, from which it differs only in such circumstances as are occasioned by position. If it is more or less transparent; if it is tougher and firmer in its texture than the parenchyma, or any of its parts; it is only because it is constantly exposed to the influence of light and air, and to the contact of such bodies as float in the atmosphere; but it is not to be regarded as constituting a distinct organ or membrane; or as exhibiting

exhibiting any proof of its being analogous to the epidermis of animals*.

Such is the substance of M. Mirbel's opinion, against which he is aware that objections may still be urged. For it may be said, If this is the true origin of the epidermis, how comes it to separate so easily from the interior parts in the spring? To this objection M. Mirbel furnishes the following reply, namely, that its facility of detachment is owing to the disorganization occasioned in it by means of its exposed situation, which has even the effect of ultimately separating it from the plant altogether, as may be seen in the instances in which it bursts and exfoliates when it is not able to expand in proportion to the internal parts. And thus M. Mirbel presumes he has got rid of all difficulties.

But the above is by no means the most formidable objection to which the hypothesis is liable. For if it be true that the epidermis is nothing more than the pellicle formed on the external surface of the parenchyma indurated by the action of the air, then it will follow that an epidermis can never be completely formed till such time as it has been exposed to that action. But it is known that the epidermis exists in a state of complete perfection, in cases where it could not possibly have been affected by the action of the external air. If you take a rose-bud or bud of any other flower before it expands, and strip it of its external covering, you will find that the petals and other inclosed parts of the fructification are as completely furnished with their epidermis as any other parts of the plant, and yet they have never been exposed to the action of the air. The same may be said of the epidermis of the seed while yet in the seed-vessel, or of the root, or of the stem of the paper birch, which still continues to form and to detach itself, though the interior layers are defended from the action of the air by the layers that invest them.

* *Traité d'Anat. et de Phys. Veg.* i. 87.

In herbs, and in the temporary parts of woody plants, such as the leaves and flowers, the epidermis never detaches itself at all ; which circumstance M. Mirbel adduces as an additional argument in favour of his hypothesis. But to me it seems an argument against it. For, if the air produces such violent effects upon the trunk and branches of woody plants, why does it not produce similar effects upon other plants, or upon other parts of the same plant? And why is the epidermis of the leaf, flower and fruit incapable of being again regenerated, if accidentally destroyed? Till a satisfactory answer can be given to these inquiries, that shall be at the same time compatible with the supposed action of the air in other cases, it is impossible to admit the hypothesis of M. Mirbel.

But so far is the action of the external air from being the cause and origin of the epidermis, that it is even detrimental to its formation. For the re-production of a part that has been accidentally destroyed, in cases capable of re-production, is always more easily effected if the wound be covered closely up*. And hence it is extremely improbable that the epidermis is merely a modification of the external surface of the parenchyma effected by the influence and action of the air ; if rather it is not evidently an organ formed by the agency of the vital principle, even when the plant is yet in embryo, for the very purpose of protecting it from injury when it shall have been exposed to the action of the air in the process of vegetation.

Accordingly the developement of the epidermis is found to keep pace with that of the plant which it invests, so that it "grows with its growth and strengthens with its strength," expanding in all its dimensions, and accommodating itself with wonderful facility to the augmentation of the inclosed parts, as may be seen in the case of trees and fruits of rapid growth. Its

* Senebier, *Phys. Veg.* i. 154.

expansion is circumscribed, however, by certain bounds or limits which it cannot pass. For, when it has become indurated with age, or when vegetation is too luxuriant, it refuses or is unable to expand further, and consequently bursts. But if it does not burst spontaneously, where it does not expand freely, it is then thought to check or retard the growth of the plant, by operating as a sort of tight roller or bandage; as may be exemplified in the case of the cherry-tree, the epidermis of which the gardener is often obliged to lay open by means of a longitudinal incision, in order to facilitate the growth of the parts inclosed.

With regard to the disavowed analogy between the animal and vegetable epidermis, it is of no consequence to the above argument whether it holds good or not. But there are several important respects in which an analogy between the two cuticles is sufficiently striking. They are both capable of great expansion in the growth of the subject. They are both easily regenerated when destroyed, (with the exceptions above stated,) and seemingly in the same manner. They are both subject, in certain cases, to a constant decay and repair; and they both protect from injury the parts inclosed. Whence we feel ourselves entitled to draw a conclusion directly the reverse of that of M. Mirbel, namely, that the epidermis of the vegetable is not an accidental scurf formed on the surface of the parenchyma by means of the action of the air; but a distinct and individual organ formed by the agency of the vital principle, at the period of the generation of the plant, and destined to the discharge of peculiar functions in the vegetable œconomy, as well as exhibiting a close analogy to the epidermis of the animal.

Stow Maries, Dec. 22, 1814.